Water Droplets Simulation using Metaballs and Lennard-Jones force field

Blender 2.77a Tutorials

Author	Nik Mohamad Aizuddin Nik Azmi
Email	nik-mohamad-aizuddin@yandex.com
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Rev#	Date	Comments
2	23. Aug. 2016	Completed draft.

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1) Start with an empty scene

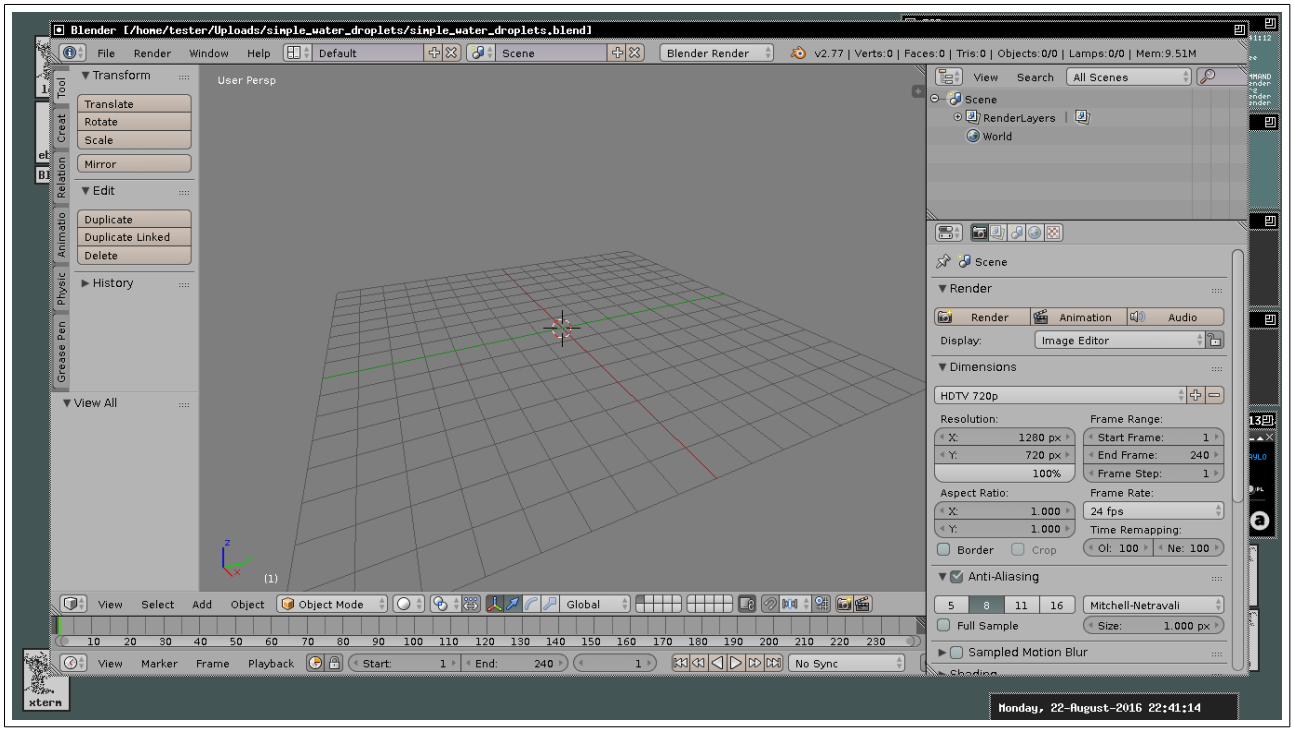

Figure 1: Empty scene

We are going to create a 10 seconds water droplets simulation. However, this is just a trick, not a realistic simulation, so the simulation will not stable and will not always work as expected.

Blender startup scene has a Cube, a Camera, and a Lamp. Delete those objects, they are not the required for this tutorial.

Set the Start Frame = 1, End Frame = 240, and Frame Rate = 24 FPS.

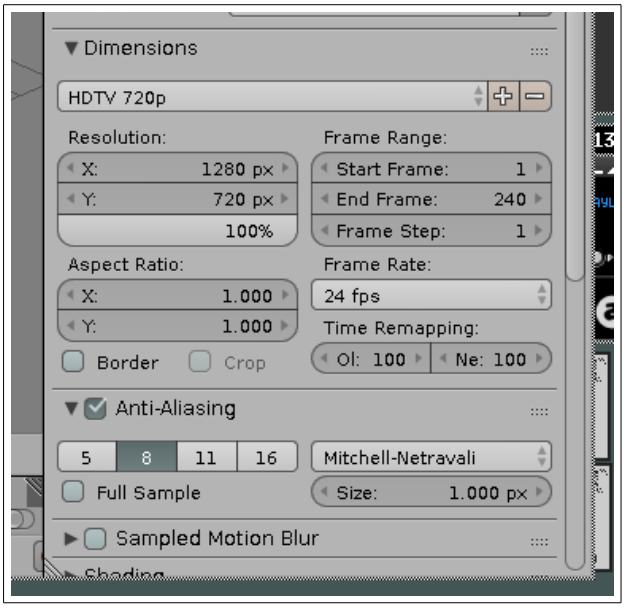

Figure 2: Start Frame, End Frame, and FPS settings

2) Create two metaballs

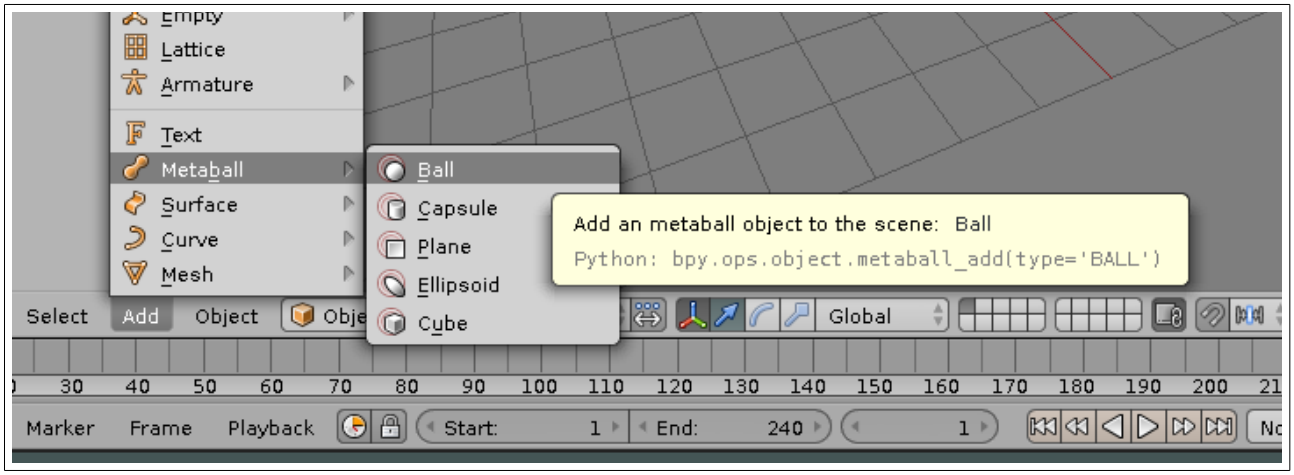

Figure 3: How to Create Metaballs

2.1) Create Mball

1. Click Add > Metaball > Ball
2. Set Location to [10, 0, 0]
3. Set Scale to [0.010, 0.010, 0.008]
4. Set Mball View Resolution and Render Resolution to 0.6
5. Set Mball Threshold to 1.4

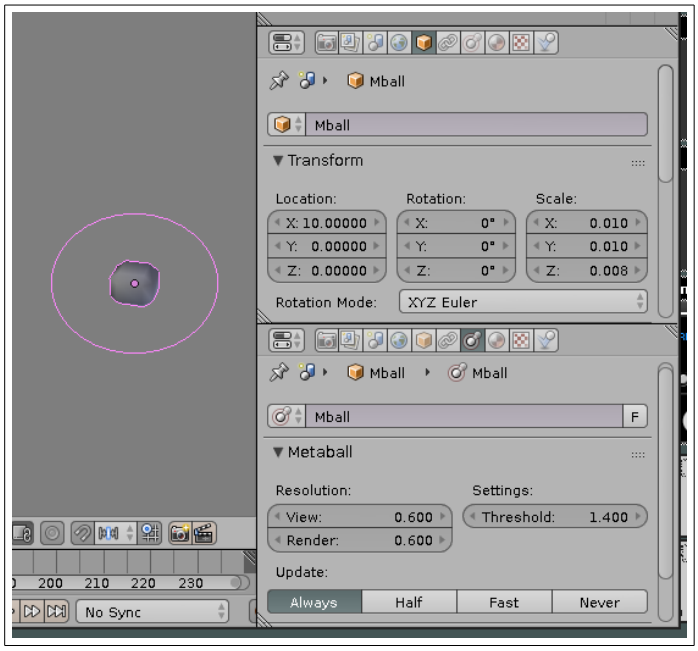

Figure 4: Mball

CAUTION: Be careful when adjusting its Resolution and Threshold. Having a low Resolution value and at the same time low Threshold value will cause your system to crash. Because, for example, when Resolution to 0.6 and Threshold to 0.6, there will be 1 millions of polygons!

2.2) Create Mball.001

1. Click Add > Metaball > Ball
2. Set Location = [11, 0, 0]
3. Set Scale = [0.012, 0.030, 0.030]
4. Set Mball View Resolution and Render Resolution = 0.6
5. Set Mball Threshold = 1.4

NOTES: If you want to rename Mball to another name, make sure its partner has ".001" postfix. For example, MballA and MballA.001. If you renamed the Metaballs different with its partner name, for example MballA and MballB, they will not merge.

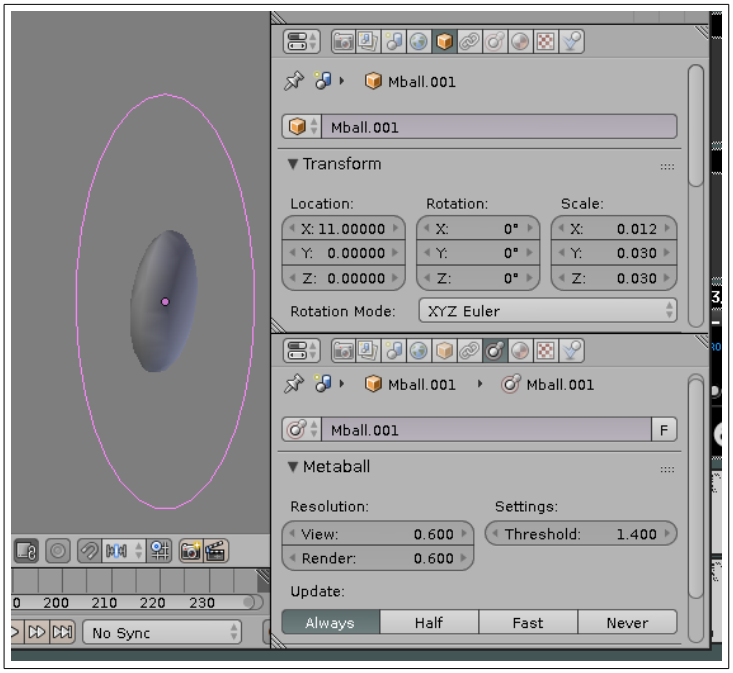

Figure 5: Mball.001

3) Create Plane

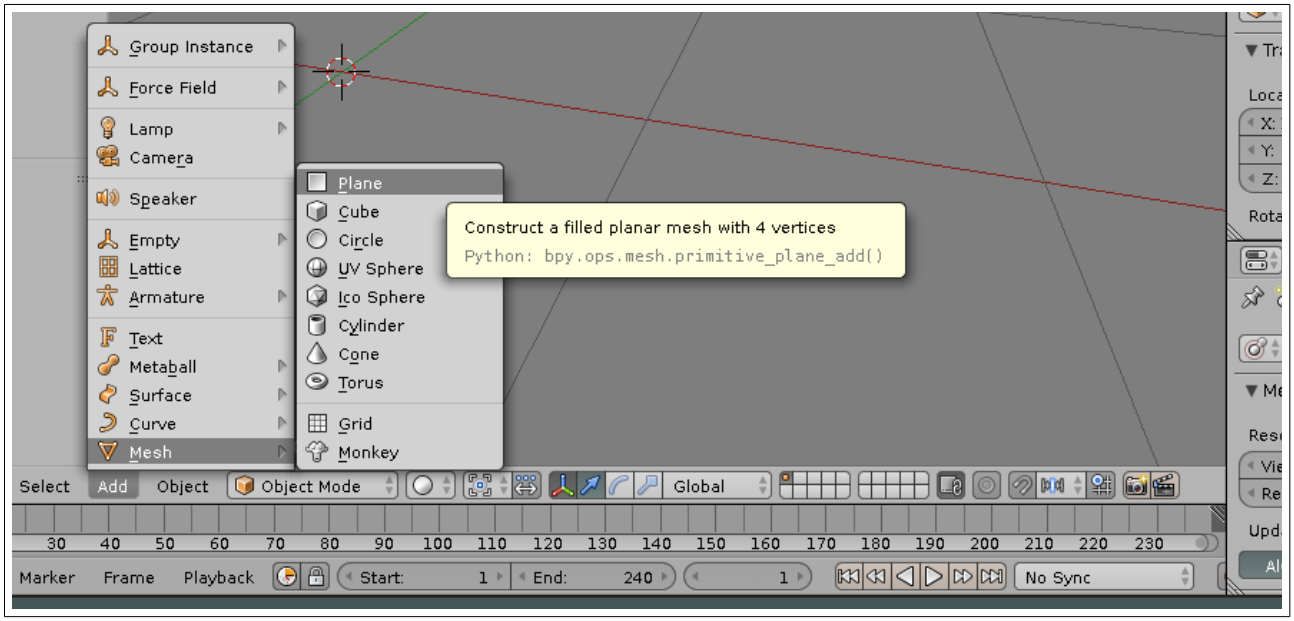

Figure 6: How to Create Plane

3.1) Set Plane rotation and scale

1. Add > Mesh > Plane
2. Set Rotation to [45, 0, 0]
3. Set Scale to [0.5, 1.0, 1.0]

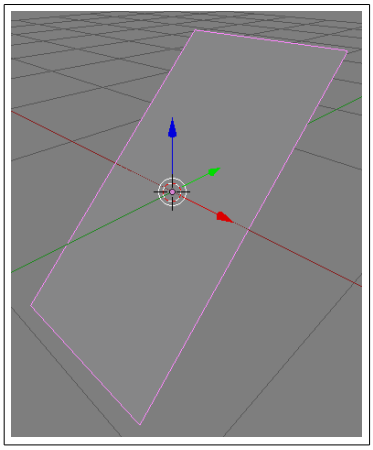

Figure 7: Plane

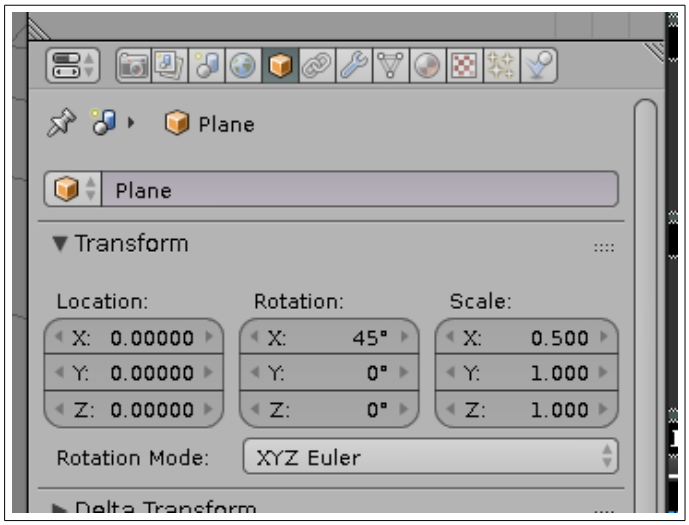

Figure 8: Plane Attribute

3.2) Create wdrop_small_static particle system

1. Goto Plane's Particle tab, and click New button. A particle system named "ParticleSystem" will appear.
2. Rename the "ParticleSystem" and "ParticleSettings" to "wdrop_small_static". Also name the Cache name as "wdrop_small_static".

NOTES: The "wdrop_small_static" is stand for water droplets small and static. Static here means that these water droplets are not affected by the Gravity force.

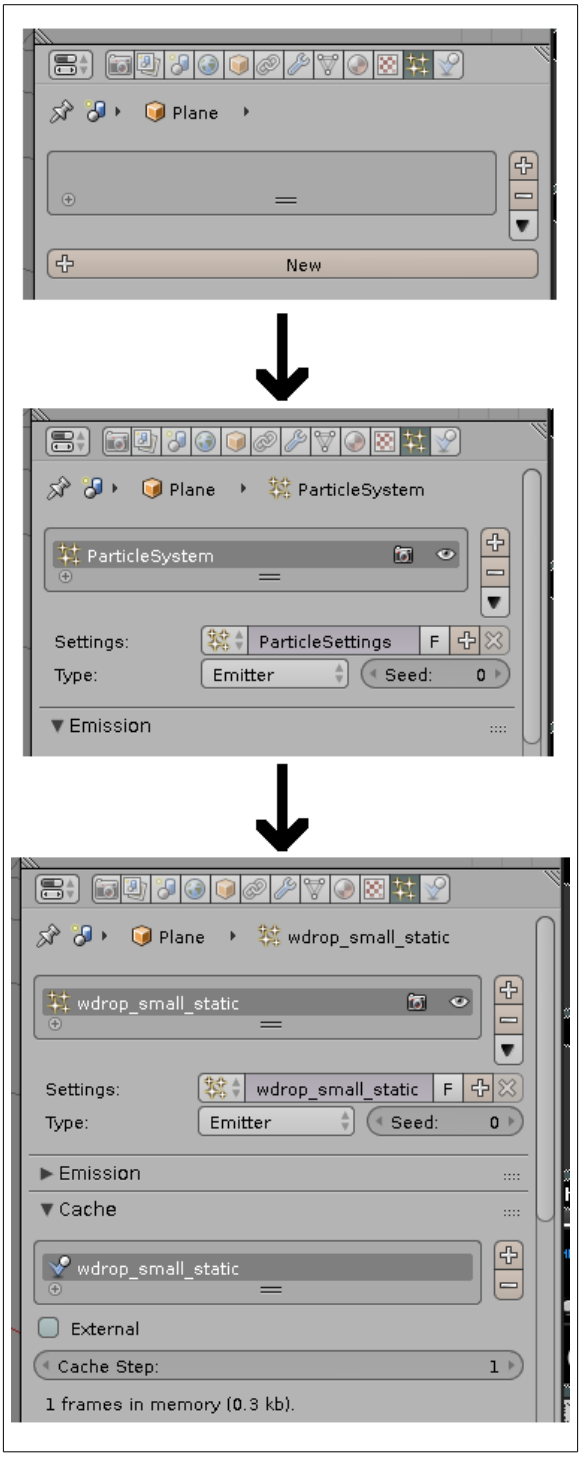

Figure 9: Create and name the particle system for the Plane

3.3) Set the wdrop_small_static particle system

1. Emission
    1.1. Number = 1000
    1.2. Start = 1
    1.3. End = 2
    1.4. Lifetime = 240
    1.5. Random = 0

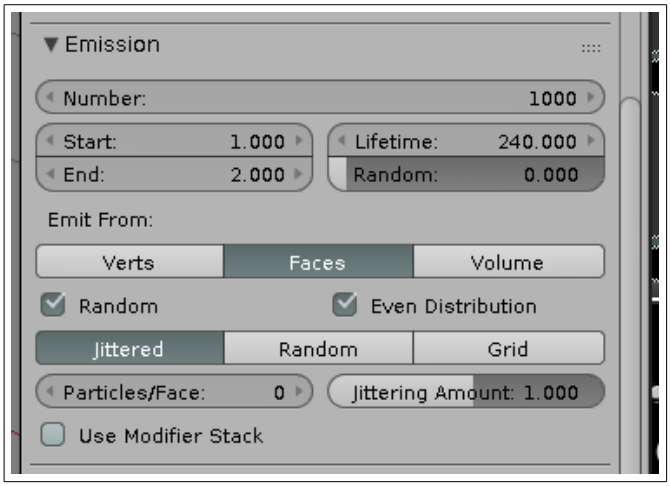

Figure 10: wdrop_small_static Particle Emission settings

2. Cache
    2.1. Disk Cache = Enabled

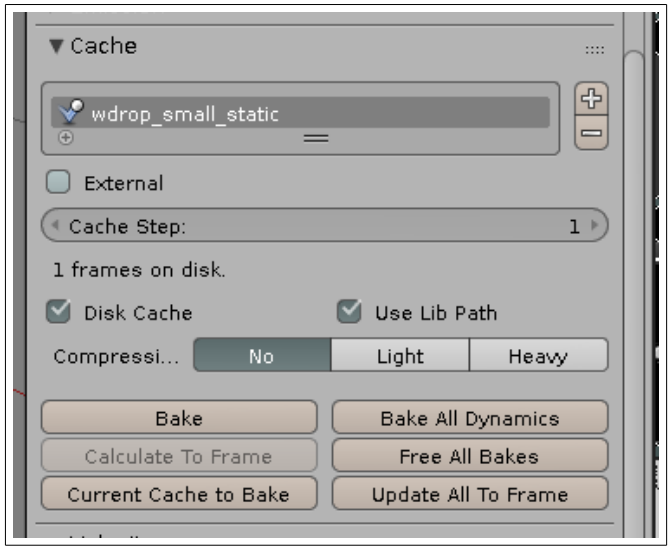

Figure 11: wdrop_small_static Particle Cache settings

3. Velocity

3.1. Normal = 0

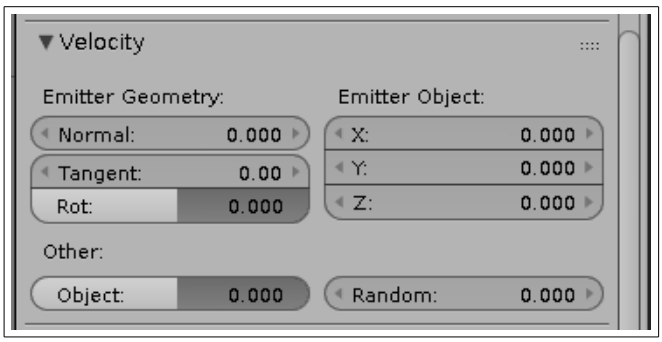

Figure 12: wdrop_small_static Particle Velocity settings

4. Rotation

4.1. Initial Orientation = Object X

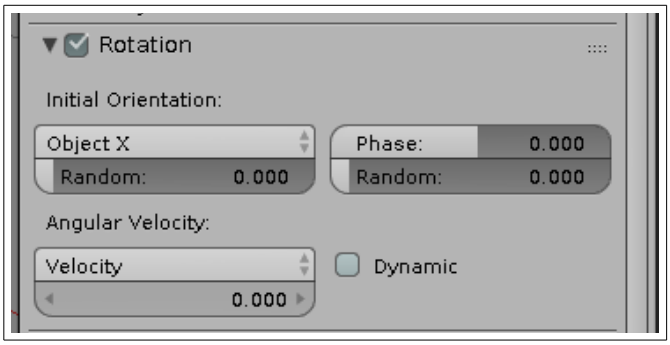

Figure 13: wdrop_small_static Particle Rotation settings

5. Physics

5.1. Physics Type = Newtonian

5.2. Size = 1

5.3. Random Size = 0.492

5.4. Mass = 0.010

5.5. Multiply mass with size

5.6. Drag = 0.050

5.7. Damp = 0.060

5.8. Subframes = 5

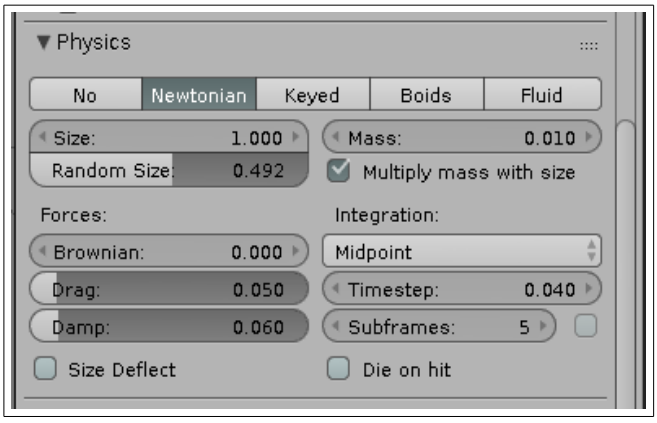

Figure 14: wdrop_small_static Particle Physics settings

6. Render

   6.1. Render Type = Object

   6.2. Duplicate Object = Mball

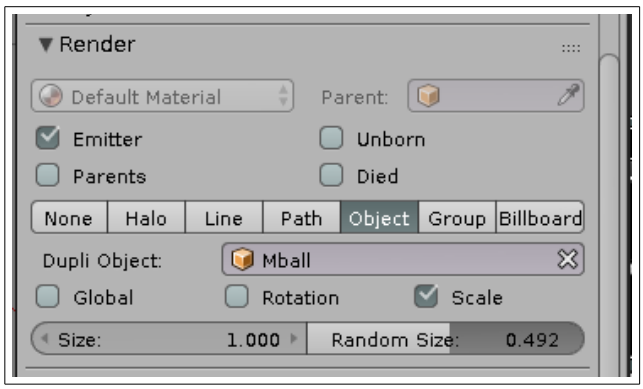

Figure 15: wdrop_small_static Particle Render settings

7. Field Weights

   7.1. Gravity = 0

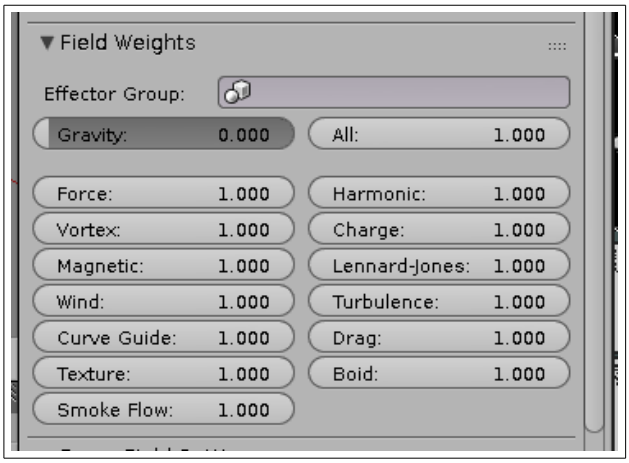

Figure 16: wdrop_small_static Particle Field Weights settings

8. Force Field Settings

   8.1. Type 1 = Lennard-Jones

   8.2. Self Effect

   8.3. Strength = -0.150

   8.4. Flow = 0.300

   8.5. Effect point = Location only

   8.6. Maximum Distance = 0.020

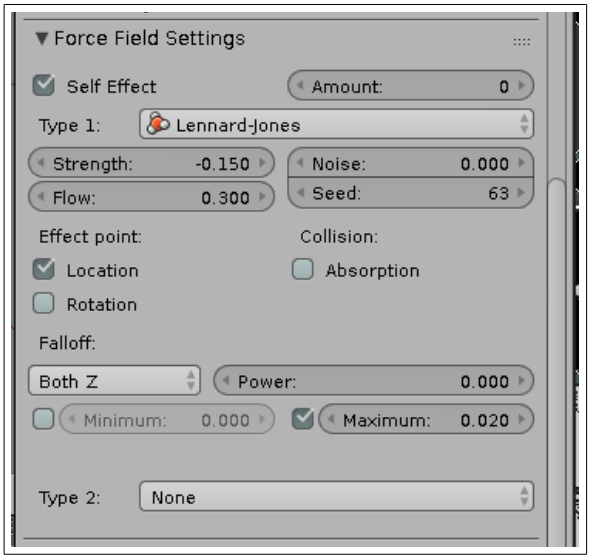

Figure 17: wdrop_small_static Particle Force Field Settings

3.4) Create particle collision on the Plane

1. Goto the Plane's Physics tab, and click the Collision button. The settings for the collision will appear.
2. Set Particle Damping Factor to 0.95
3. Set Particle Friction Factor to 0.20

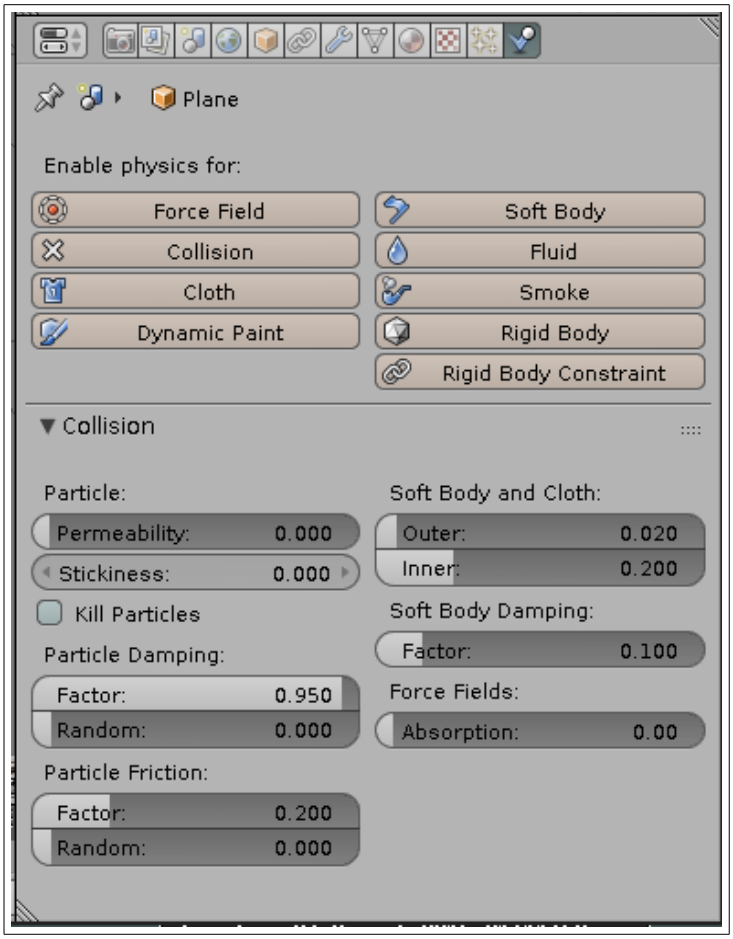

Figure 18: Plane Particle Collision settings

4) Create DynamicWdrop_Emitter Plane

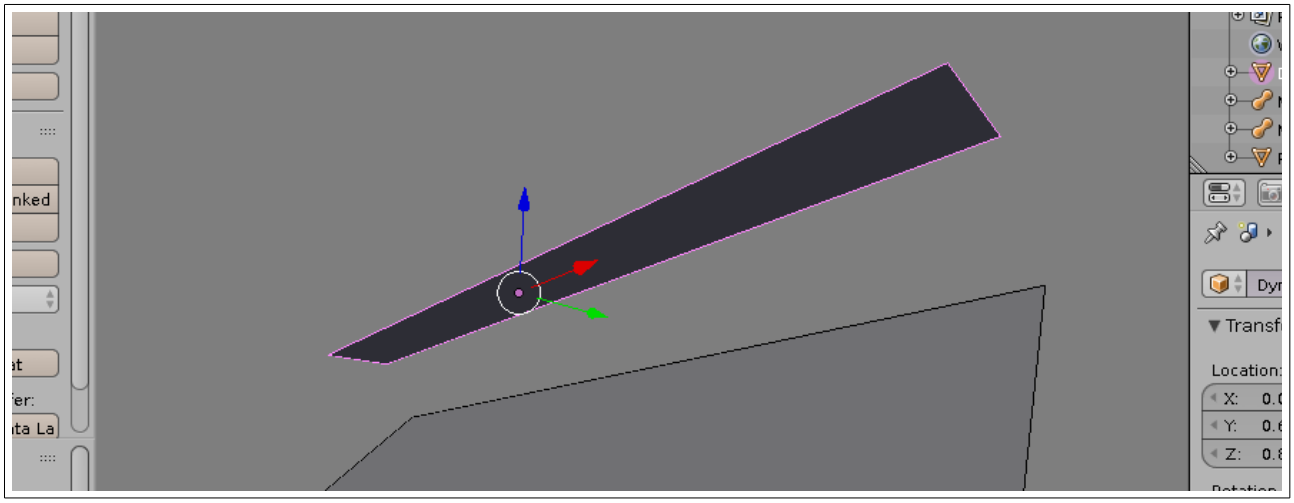

Figure 19: The DynamicWdrop_Emitter Plane

"DynamicWdrop_Emitter" is stands for dynamic water droplets emitter. This plane will emit dynamic water droplets particle. The term dynamic here means the particle will be influenced by Gravity force.

1. Add > Mesh > Plane
2. Rename it to DynamicWdrop_Emitter

4.1) Set DynamicWdrop_Emitter location and scale

1. Set Location to [0.0, 0.6, 0.8]
2. Set Scale to [0.50, 0.05, 0.50]

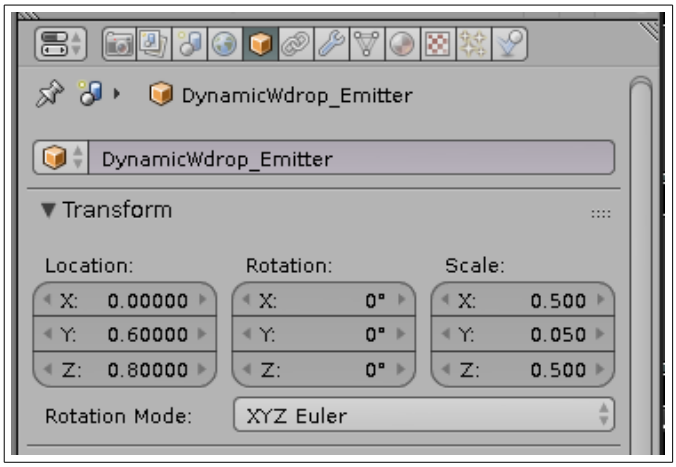

Figure 20: DynamicWdrop_Emitter's Location and Scale

4.2) Create wdrop_large_dynamic particle system

1. Goto the Particle tab, and create a new particle system for DynamicWdrop_Emitter plane.
2. Rename the particle system including its Cache name to "wdrop_large_dynamic".
3. Set Seed value to 1 or any value as long as it is different from wdrop_small_static's Seed value.

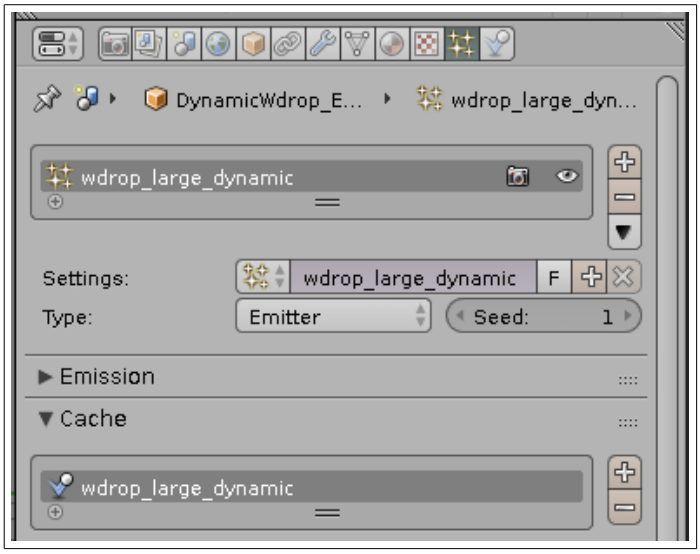

Figure 21: DynamicWdrop_Emitter's particle system name

4.3) Set the wdrop_large_dynamic particle system

1 Emission

1.1 Number = 10

1.2 Start = 1

1.3 End = 240

1.4 Lifetime = 240

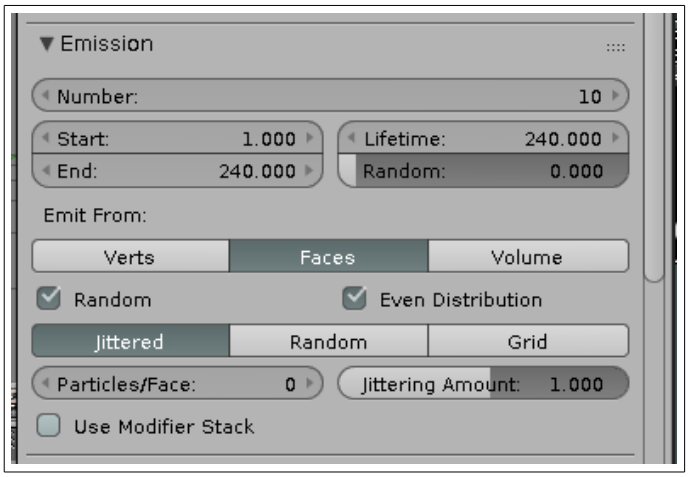

Figure 22: wdrop_large_dynamic Particle Emission settings

2 Cache

2.1 Disk Cache = Enabled

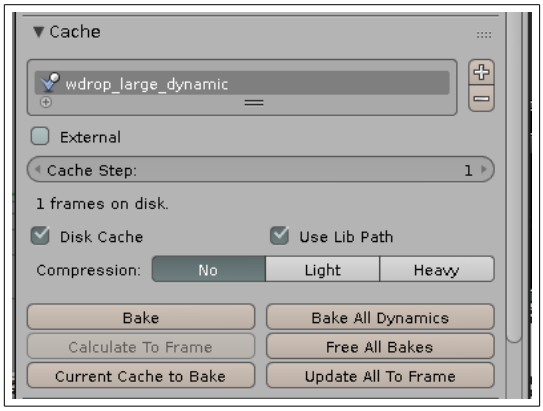

Figure 23: wdrop_large_dynamic Particle Cache settings

3 Velocity

3.1 Normal = 0

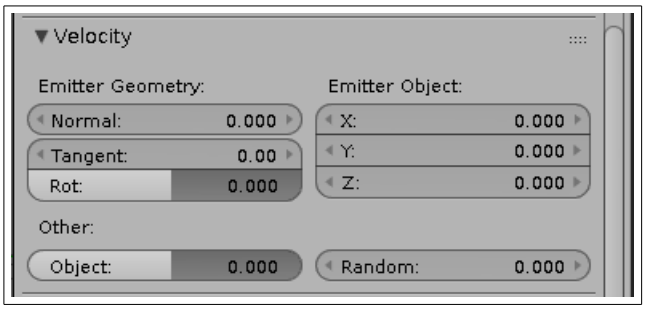

Figure 24: wdrop_large_dynamic Particle Velocity Settings

4 Rotation

4.1 Initial Rotation = Velocity/Hair

4.2 Angular Velocity = Velocity

4.3 Dynamic Angular Velocity

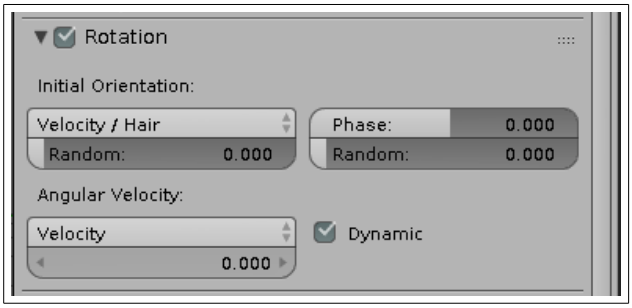

Figure 25: wdrop_large_dynamic Particle Rotation settings

5 Physics

5.1 Physics Type = Newtonian

5.2 Size = 1

5.3 Mass = 0.020

5.4 Drag = 0.010

5.5 Damp = 0.045

5.6 Subframes = 5

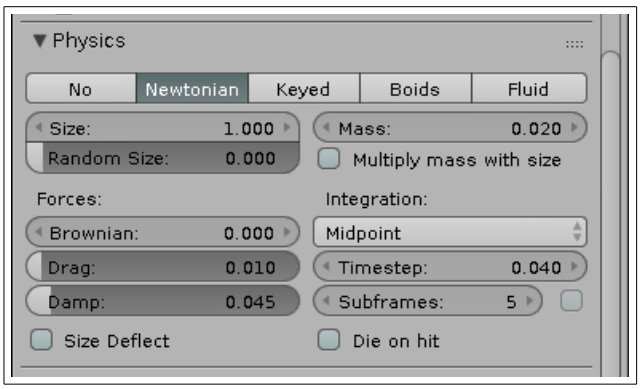

Figure 26: wdrop_large_dynamic Particle Physics settings

6 Render

6.1 Render Type = Object

6.2 Duplicate Object = Mball.001

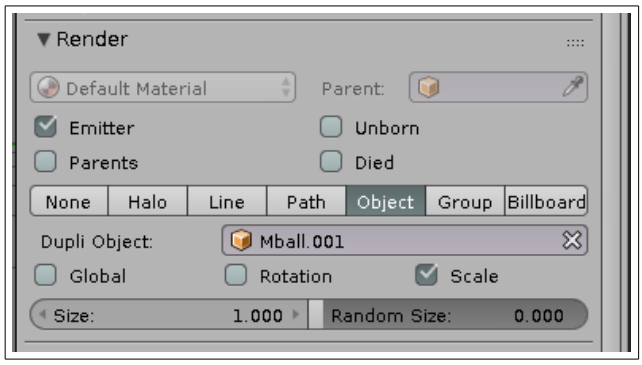

Figure 27: wdrop_large_dynamic Particle Render settings

7 Field Weights

7.1 Enable all field weights

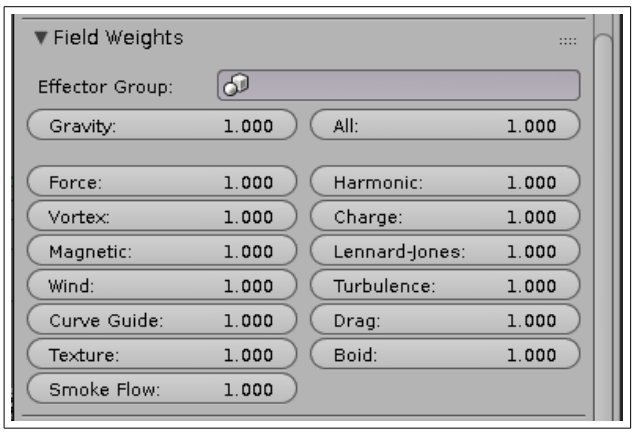

Figure 28: wdrop_large_dynamic Particle Field Weights settings

8 Force Field Settings

8.1 Type 1 = Lennard-Jones

8.2 Strength = -0.3

8.3 Flow = 0.3

8.4 Effect point = Location only

8.5 Falloff Max Distance = 0.035

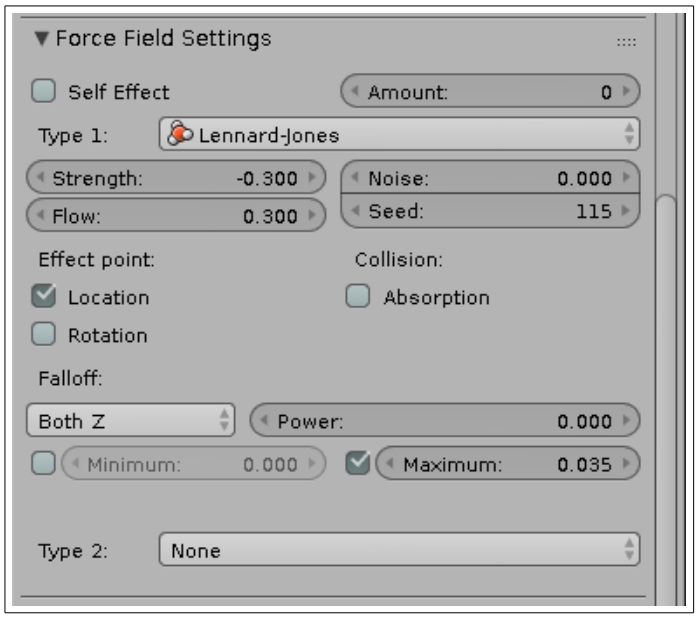

Figure 29: wdrop_large_dynamic Particle Force Field settings

5) Assign materials to Plane and DynamicWdrop_Emitter (optional)

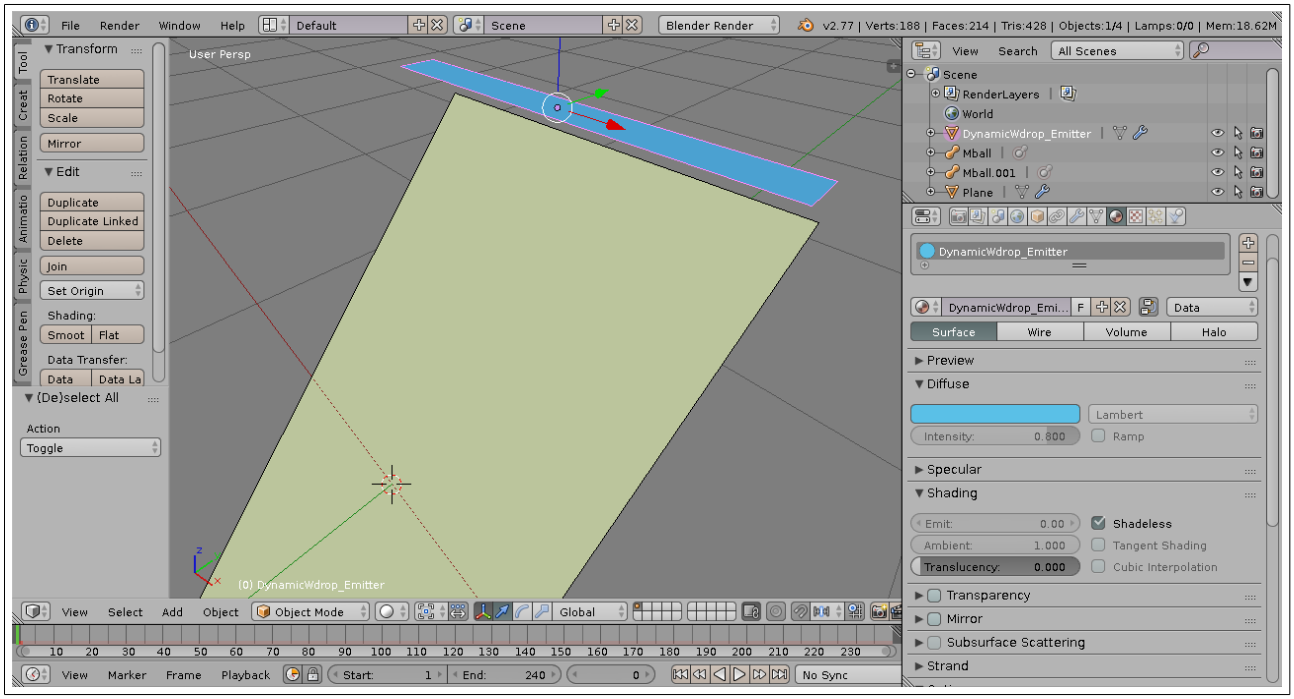

Figure 30: Assign Materials

For convenient purposes, assign some materials to the objects.

5.1) Material properties for Plane

1. Diffuse color = F2FFCA
2. Shading = Shadeless

5.2) Material properties for DynamicWdrop_Large_Emitter

1. Diffuse Color = 5AC0E7
2. Shading = Shadeless

5.3) Material properties for Mball

1. Diffuse Color = 0079CF
2. Shading = Shadeless

6) Simulate the water droplets

6.1) Bake All Dynamics

Select either Plane or DynamicWdrop_Emitter, goto the Particle tab, under section Cache, click the button Bake All Dynamics.

It took 4 minutes and 10 seconds on my Acer Aspire 4741 laptop.

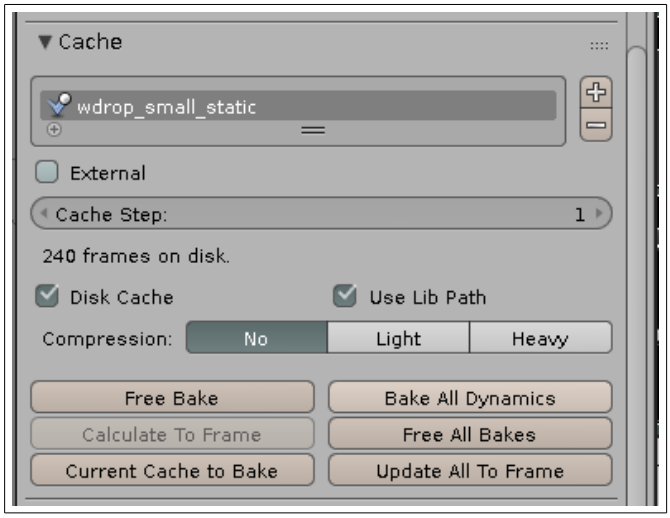

Figure 31: Bake All Dynamics

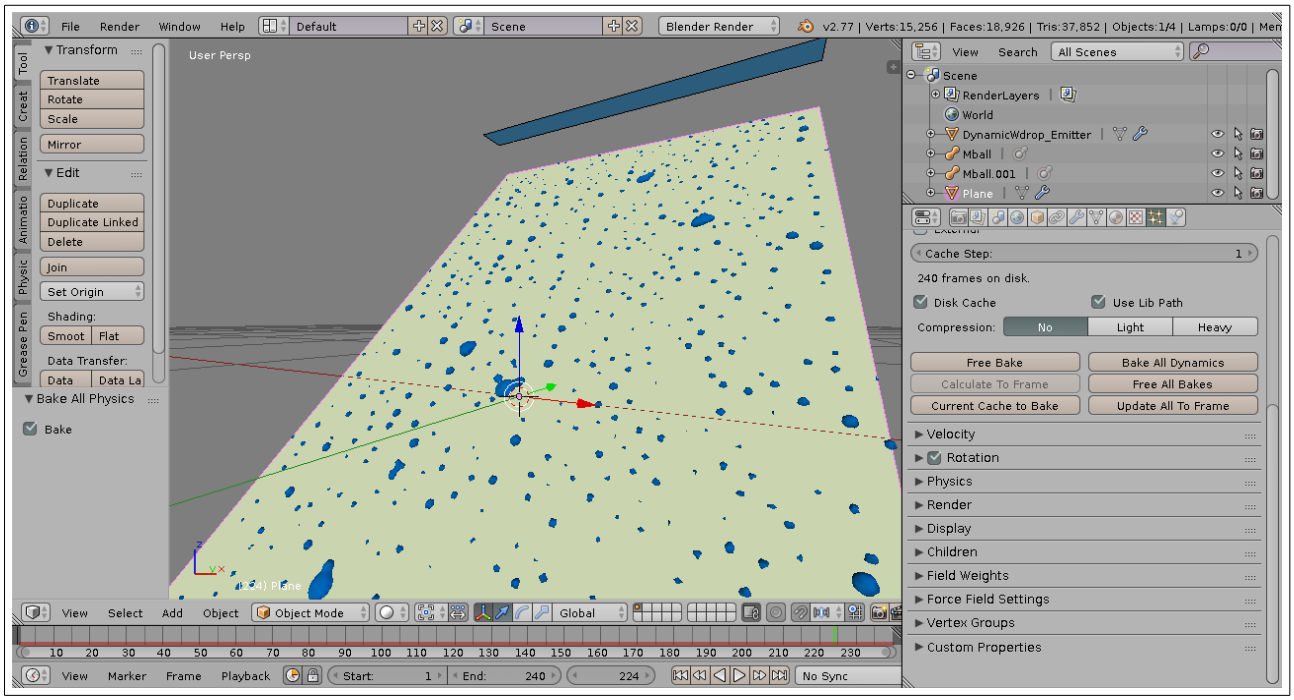

Figure 32: The final result

Now you can play to see the water droplet simulation.